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An ion beam milling system and method for electron microscopy specimen preparation is provided and is useful for the preparation for analysis by either TEM or SEM of semiconductors, metals, alloys, ceramics, and other inorganic materials. In one embodiment, a system and process are provided for the preparation of specimens for analysis by transmission electron microscopy including a specimen processing chamber, at least two ion beam generators, and a specimen support or holder. An ion beam masking member is secured to a surface of the specimen and the specimen is milled. Preferably, the system also includes the ability to view the progress of the milling operation and may include an imaging device such as a light microscope which permits monitoring of the area of interest on a specimen as the specimen is milled.